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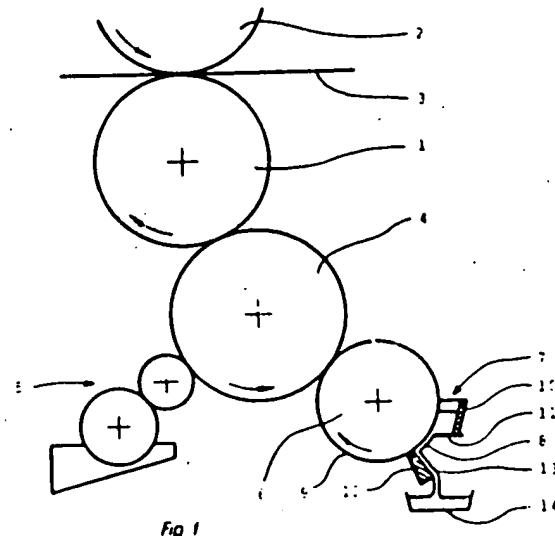
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(54) Inking unit for a printing machine

(57) The inking unit includes an inking device 7 which is set against an inking roller 6 provided with a resilient surface and creates a premetered ink film 8 on the inking roller 6 and metering ledge 12 which wipes the premetered ink film 8 to the size required for transfer to a forme cylinder 4, the wiped-off, excess ink 13 running off freely, the metering ledge 12, for the purpose of self cleaning, executing a movement preferably directed in the peripheral direction of the inking roller 6 so that the area in contact with the inking roller 6 and forming the metering gap constantly changes.



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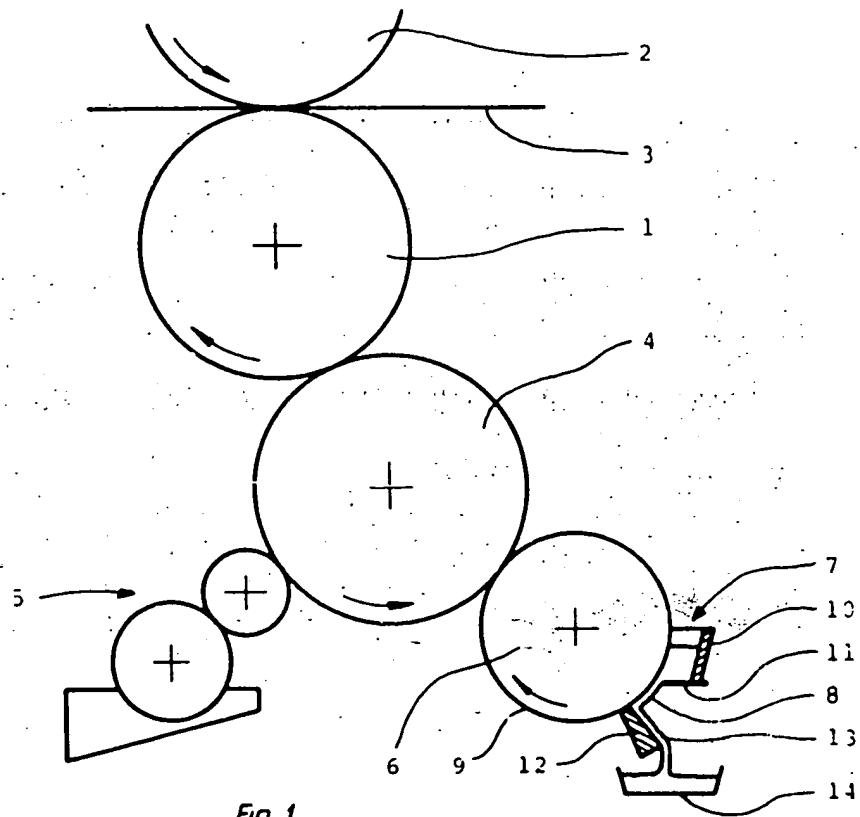


Fig. 1

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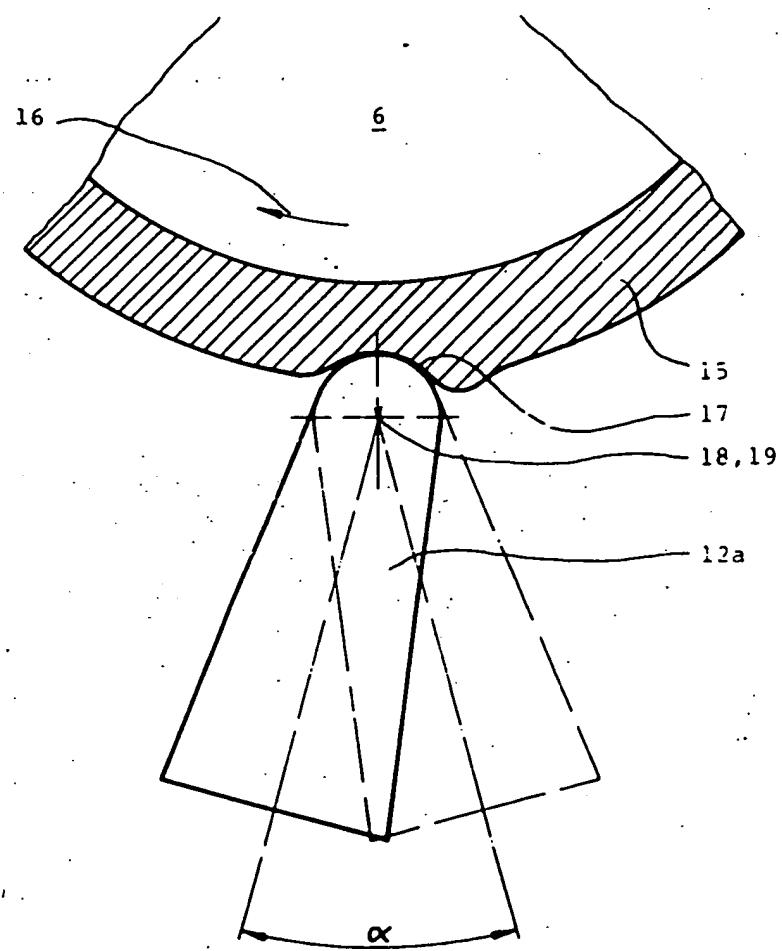


Fig. 2

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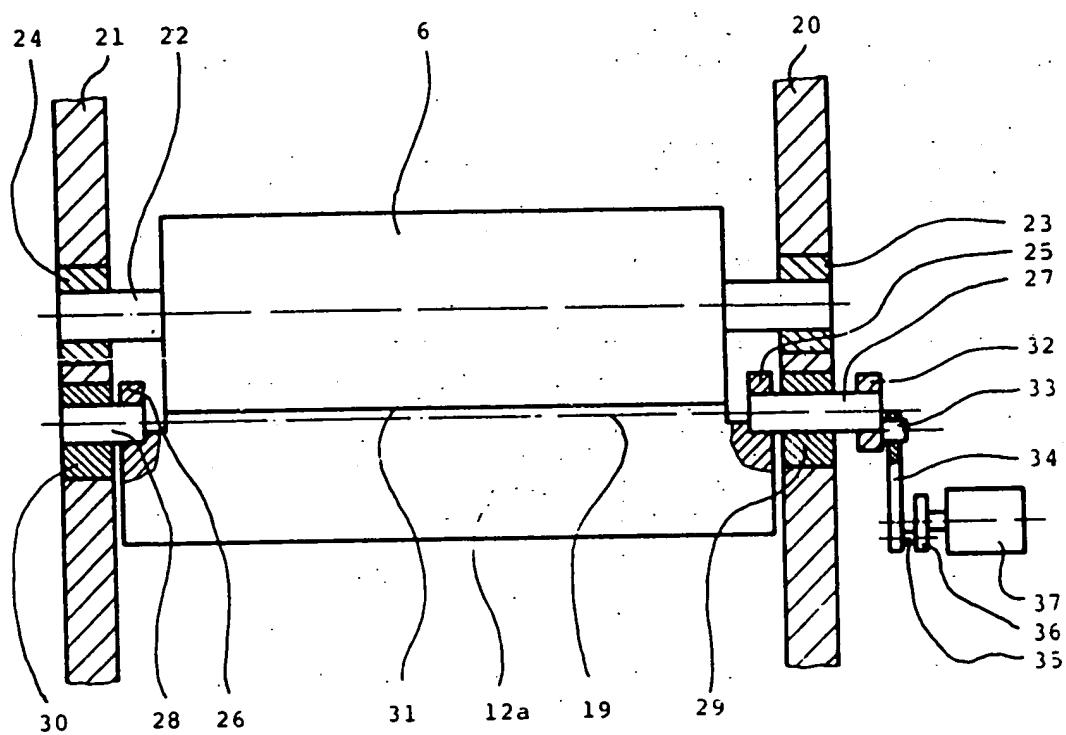


Fig. 3

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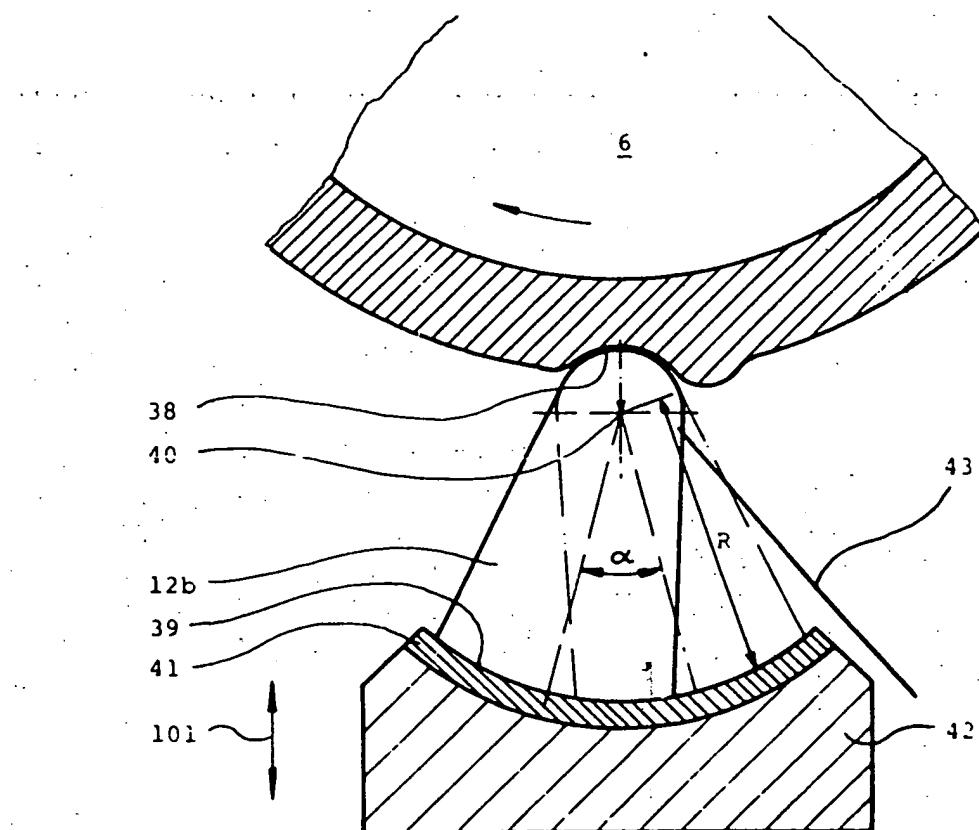


Fig. 4

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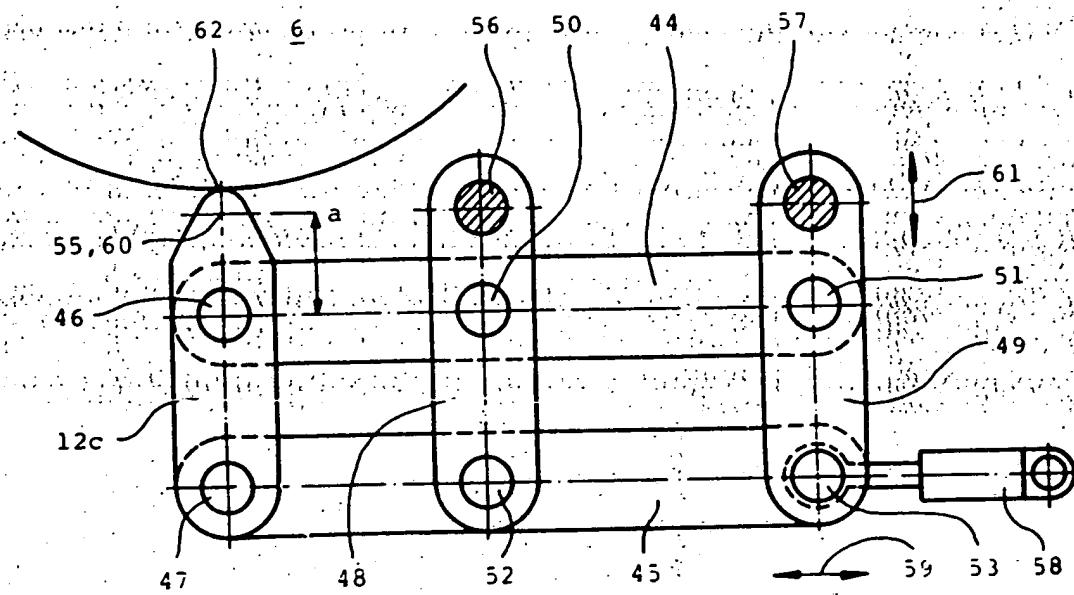


Fig. 5

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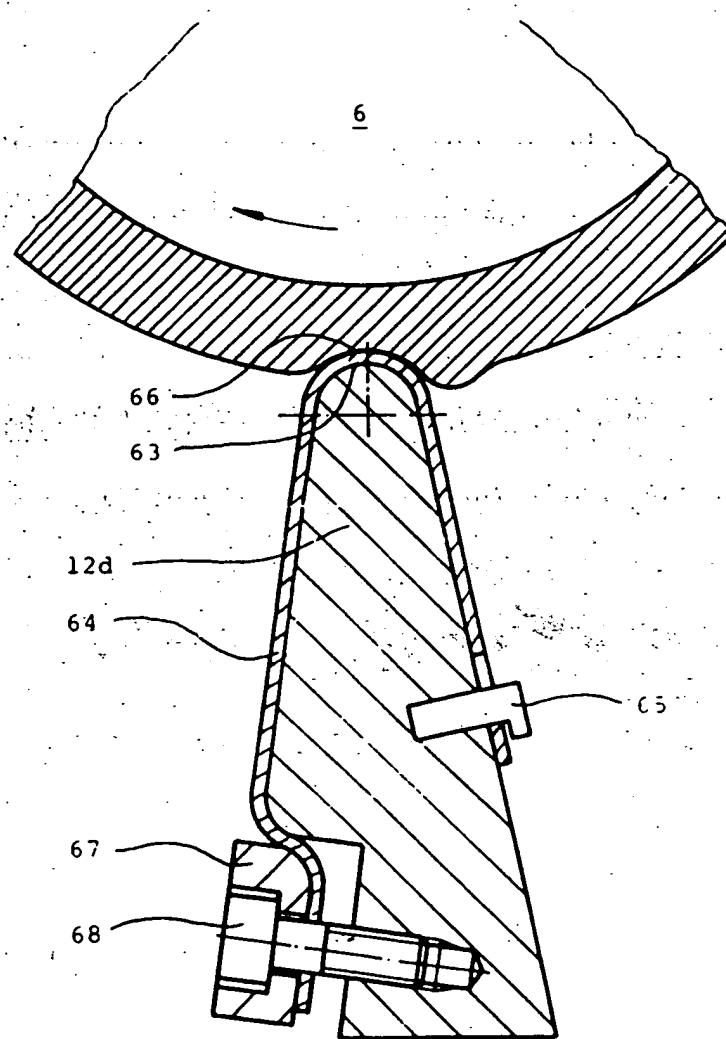


Fig. 6

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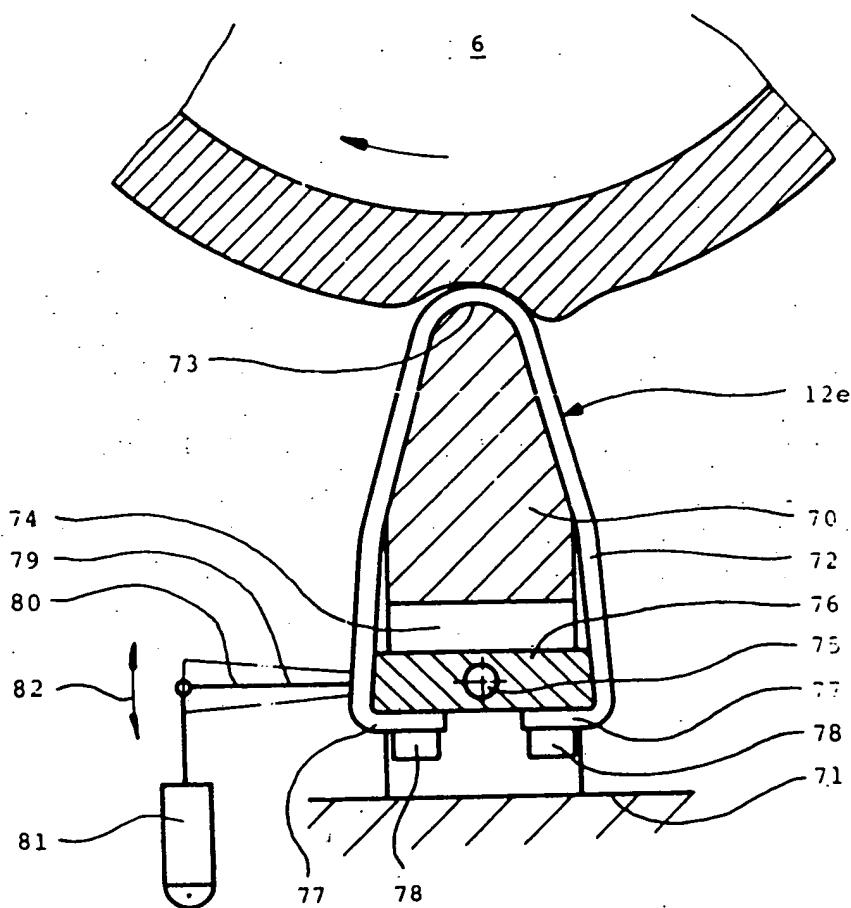


Fig. 7

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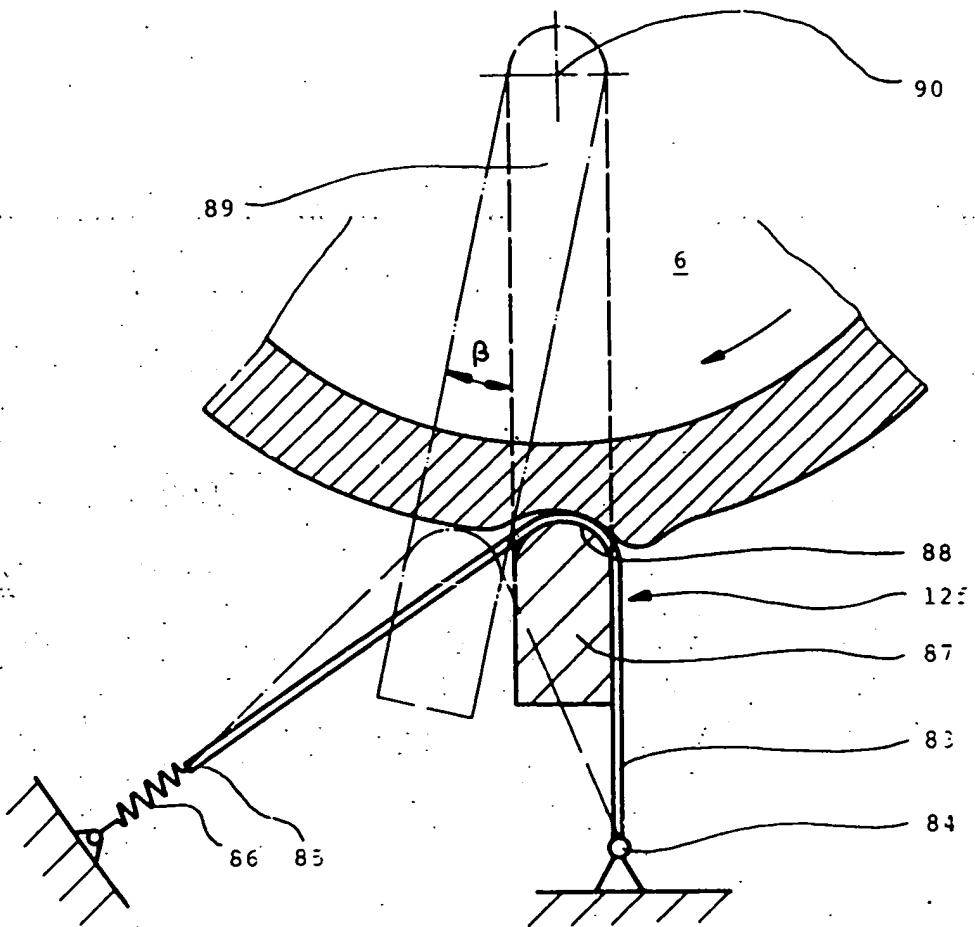


Fig. 8

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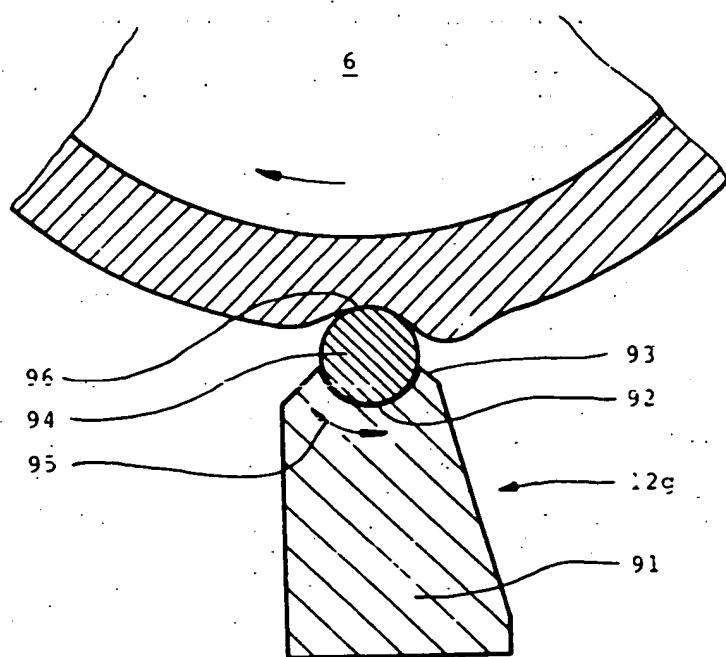


Fig 9

Inking unit for a printing machine

The invention relates to an inking unit for a printing machine, comprising at least one forme cylinder, for carrying a printing forme, an inking roller which is set against the forme cylinder and has a resilient surface, an inking device which inks the inking roller, and a metering device which can be set against the inking roller.

German Offenlegungsschrift 3,225,982 discloses an arrangement of this type. Here, the ink is transferred by an ink fountain, bounded on the one side by an ink retaining wall and on the other side by a metering member, to the inking roller provided with a resilient surface. The metering member, which is set virtually tangentially against the inking roller, creates on the inking roller a thin ink film suitable for the transfer to the forme cylinder; that is, it retains the ink located in the ink fountain except for the quantity drawn off through the gap between metering member and inking roller. As a result of the very small ink quantity thus drawn off, an existing ink supply remains in the ink fountain for a considerable time.

A large hydrodynamic pressure develops in the ink gap as a result of the relatively large bearing or supporting surface of the metering member. So that a sufficiently thin, constant ink film can then be achieved, the metering member has to be pressed with considerable force against the elastic surface of the inking roller. As a result of this high setting force, the elements participating in the metering operation are highly stressed, which leads to increased wear of these elements. As the stress on these elements increases, however, excessive heating occurs at the same time, in particular of the ink. The ink heats up quite considerably especially in the area of the metering member edge, since the ink supply is drawn off only very slowly through the metering gap. This temperature increase can lead to the property of the ink changing, which immediately has its effects

on the printing quality. It is attempted to keep the heating under control with cooling devices of appropriately large dimensions.

As a result of the large contact pressure, necessary due to the hydrodynamic pressure of the ink in the metering gap, on the metering member, and the virtually tangential setting of the metering member against the inking roller, there is in addition the risk of the front edge of the metering member being dragged into the inking roller as a result of the resilient nature of the inking roller surface. This can happen in particular when there is a lack of ink and can then lead to considerable damage to the entire printing unit.

The ink turbulence occurring in the ink fountain, which on the one hand is desired in order to keep the edge of the metering member free from dirt particles, on the other hand certainly also leads to disturbances in the thin ink film which is to produce a high degree of uniformity. But this turbulence does not safely eliminate contamination of the edge of the metering member. However, the dirt particles adhering to the edge of the metering member cause streaks in the ink film on the inking roller which are then transferred to the plate cylinder despite the ink-supply jockey rollers and thus also become visible on the printed copy. Without an external effect, these dirt particles remain adhering to the edge of the metering member and have an adverse effect on the printing quality until the metering member is cleaned.

Other tests to create an ink film by means of a single metering member on the inking roller provided with a resilient surface, which ink film meets the requirements necessary for the transfer to the forme cylinder, have also proved a failure, in particular on account of the occurrence of the contamination problems, which is why none of the proposed solutions have so far been able to succeed.

The object of the present invention, then, is to create an inking unit which has the least possible number

of rollers and transfers an ink film, created directly on the inking roller provided with a resilient surface, to the printing forme carried by a forme cylinder, the uniformity of which ink film is ensured during the printing operation without the metering element and the inking roller, which has a resilient surface, being subjected to excessive stresses, as a result of which the wear and the temperature increase can be kept very low. At the same time, the metering element is to eliminate disturbing dirt particles on the metering edge.

This object is achieved by the following combination of features:

- the inking device produces a premetered ink film on the inking roller,
- the metering device comprises at least one metering ledge which wipes the premetered ink film on the inking roller to the size required for the transfer to the forme cylinder,
- the excess ink wiped from the metering ledge runs off freely,
- the metering ledge is mounted in such a way that at least one part of the metering ledge forming the metering gap, for the purpose of constant self-cleaning, can be set in an oscillating movement, preferably in the peripheral direction of the inking roller, in such a way that another area of the metering ledge, with the inking roller, constantly forms the metering gap.

The oscillating movement of at least one part of the metering ledge to a small extent effectively prevents contaminating particles from collecting and sticking on the edge of the metering ledge, since the metering ledge area in engagement constantly changes. The contaminating particles are thus constantly washed away, on the one

hand by the excess ink drawn off from the metering ledge and on the other hand by the metered ink film itself, so that streak formation by contaminating particles on the inking roller can be eliminated.

Turbulence, which could have a disturbing effect on the ink film metered ready for use, is largely avoided, since only an ink film premetered on the inking roller runs against the metering strip and the excess ink can flow away unimpeded. This excess ink is advantageously collected by a collecting tank and either fed to an ink preparation unit, from where it is conveyed back again into the inking device, or fed again directly to the inking device. Suitable dimensioning of the premetered ink quantity by the inking device and the brief retention time of the ink in the inking device prevent the ink and the elements participating in the creation and metering of the final ink film from being heated excessively so that even additional cooling can be dispensed with.

So-called "ghost images" on the printed product are likewise avoided with this inking unit. The inking device constantly creates on the inking roller a completely new ink film which is reduced to the finished size by the metering ledge and transferred to the printing forme. Thus the inking roller can have a different diameter, preferably smaller, than the forme cylinder.

In an advantageous further development of the generic measures, the oscillating movement of the metering ledge in the peripheral direction of the inking roller can be achieved by the metering ledge being provided with a cylindrical metering edge, and by the metering ledge being pivotable about the axis of the cylinder defined by the edge rounded off cylindrically. The metering ledge is conveniently mounted by bearing journals which are arranged on the front ends of the metering ledge and whose rotational axis coincides with the axis of the cylinder defined by the edge rounded off cylindrically. This ensures that the thickness and shape of the metering gap remain exactly the same when the metering ledge pivots.

In a further advantageous development of the generic measures, the metering ledge can rest on a bearing beam provided with bearing elements. As a result of this arrangement, the metering ledge is solidly supported over the entire width of the inking roller. By adjusting elements on the bearing beam, the metering gap between inking roller and metering ledge is also very simple to set.

A further advantageous development of the generic measures can be effected by the metering ledge being connected in an articulated manner to two guide links parallel to one another. These two guide links are articulated on two pivot levers parallel to the metering ledge. At one of their ends, the pivot levers are held in fixed bearings, the centres of rotation of the fixed bearings and the centre of rotation of the rotational axis of the metering ledge lying in a straight line. In this way, it is not necessary to attach any bearing arrangements in direct proximity to the surface of the inking roller. Thus a plurality of metering ledges can also be arranged over the width of the inking roller. The metering gap between inking roller and metering ledge is set in a simple manner when one of the fixed bearings of a pivot lever can be adjusted about the other fixed bearing of the other pivot lever by appropriate means.

In order to protect the very accurately machined metering edge of the metering ledge, a flexible, foil-like plate can be stretched in an advantageous manner over this metering edge, which plate is fixed in such a way that it is easy and simple to exchange.

The area of the metering strip forming the metering gap can also be moved by the foil which is stretched over the metering ledge being moved reciprocatingly in an oscillating manner in the peripheral direction of the inking roller. This results in the advantage that the metering ledge can be mounted in a fixed manner.

In all these embodiments described, a plurality of page-wide metering ledges and inking devices can readily be arranged side by side in a known manner for

multi-page-wide printing machines. By this side-by-side arrangement, page-wide ink separation is possible without problem.

Further expedient embodiments and advantageous further developments of the generic measures are apparent from the remaining subclaims.

The invention is described below and shown in exemplary embodiments in the drawing, in which:

Fig. 1 shows a schematically represented printing unit of a rotary offset printing machine with an inking and damping unit;

Fig. 2 shows a schematic representation of the pivotable metering ledge;

Fig. 3 shows a schematic representation of a bearing arrangement of the metering ledge;

Fig. 4 shows a section through a bearing arrangement of the metering ledge on a bearing beam;

Fig. 5 shows the metering ledge mounted by means of pivot levers and guide links;

Fig. 6 shows a section through a metering ledge provided with a protective layer;

Fig. 7 shows a section through a metering ledge which is equipped with an oscillating, flexible, foil-like plate which can be moved in a reciprocating manner;

Fig. 8 shows a section through a supporting element which can be pivoted about the inking roller axis and has a flexible, foil-like plate; and

Fig. 9 shows a section through a metering ledge consisting of a supporting beam and a rotatable bar.

The printing unit, shown schematically in Fig. 1, of a rotary offset printing machine consists of a blanket cylinder 1 against which a counterpressure cylinder 2 is set, but this counterpressure cylinder 2 can also be designed as a further blanket cylinder. The paper web 3 to be printed is passed through and printed between the blanket cylinder 1 and the counterpressure cylinder 2. A forme cylinder 4 carrying printing formes is set against the blanket cylinder 1. Allocated to this forme cylinder 4 is a schematically represented, known damping unit 5 which transfers the damping agent to the printing formes. Also in contact with the plate cylinder 4 is an inking roller 6 which has a resilient surface. Created on this inking roller 6 by an inking device 7 is a premetered inking film 8 of a constant size over the entire width of the inking roller 6, the thickness of which ink film 8 is several times larger than that of the ink film 9 which can be transferred to the forme cylinder 4. In the present embodiment, the inking device 7 consists of an ink fountain 10 which is provided with an ink blade 11 which determines the metering rate and can be adjusted in a known manner. Also conceivable are other known inking devices which can produce a premetered ink film 8 on an inking roller 6. The premetered ink film 8, which is received by the inking roller 6, is wiped with a metering ledge 12 arranged subsequent to the inking device 7. Thus the ink film 9 develops which can be transferred to the forme cylinder 4. The excess ink 13 wiped from the metering ledge 12 runs freely into a collecting tank 14 from which the collected ink is passed directly into the inking device 7 or into an ink preparation unit (not shown) and pumped from there back into the inking device 7.

The ink film 9 which can be transferred to the forme cylinder 4 has a constant thickness over the entire width of the inking roller 6. This thickness can be adjusted by setting the metering ledge 12 against the inking roller 6 to a greater or lesser degree, which can be effected by known adjusting mechanisms (not shown).

The inking device 7 continually creates a completely new pre-metered ink film 8 on the inking roller 6 so that the latter, rotating at the same peripheral speed as the forme cylinder 4, can have a different, preferably smaller, diameter than the forme cylinder 4 without there being the risk of so-called "ghost images" arising.

Figure 2 shows a detail of the inking roller 6, which is in contact with the metering ledge 12a. The inking roller 6 is provided with a resilient layer 15 and rotates in the direction of arrow 16. At the edge 17 facing the inking roller 6, the metering ledge 12a has a cylindrical surface. The axis 18 of this cylindrical surface is also the rotational axis 19 about which the metering ledge 12a can be pivoted through the angle α .

Figure 3 shows how the metering element 12a can be mounted in a printing machine. The inking roller 6 is arranged between two side walls 20 and 21 of the printing machine. The spindle 22 of the inking roller is rotatably mounted in two bearings 23 and 24 which are fixed in the side walls 20 and 21. At each of its front ends, the metering ledge 12a has brackets 25 and 26 respectively in which bearing journals 27 and 28 are fixed non-rotationally. The bearing journals 27 and 28 are rotatably mounted in excentrics 29 and 30. The excentrics 29 and 30 are in turn mounted in side walls 20 and 21 respectively in such a way that they can be turned by means not shown and fixed in the new position. Thus the metering gap 31, formed by the inking roller 6 and the metering ledge 12a, can be adjusted.

The bearing journal 27 extends in its longitudinal direction beyond the side wall 20. Attached non-rotationally on this extension is a lever 32 which is connected to a guide link 34 in an articulated manner by means of the bearing journal 33. The guide link 34, with its other end, is placed rotatably onto a pin 35 which is fixed in a disc 36 which is set in rotation by a motor 37. The pin 35 is at a selectable distance from the centre of rotation of the disc 36, whereby the angle α , through which the metering ledge 12a can be pivoted,

can be established. The rotational speed of the motor 37 determines the frequency with which the metering ledge 12a moves.

Figure 4 shows a further means by which the metering ledge 12 can be mounted. The metering ledge 12b, which again has a cylindrical surface at the edge 38 facing inking roller 6 equipped with a resilient surface, is likewise of cylindrical configuration at the side 39, remote from the inking roller 6, whose distance R from the rotational axis 40 is constant. With its side 39 of cylindrical configuration, the metering ledge 12b rests on a correspondingly formed bearing element 41 which is fixed on a bearing beam 42. The bearing element 41 can, for example, be a sliding bearing. The metering ledge 12b can now be moved in a reciprocating manner on the bearing element 41 by means not shown. At the same time, due to the side 39 of cylindrical configuration, it executes a pivoting movement whose centre of rotation lies in the rotational axis 40. In order to prevent the bearing element 41 from being contaminated, the metering ledge 12b is provided with a protective sheet 43 which diverts the ink wiped from the metering ledge 12b around the bearing element 41. Fig. 4 shows the two extreme positions of the pivotable metering ledge 12b (left: solid line; right: broken line). So that the metering gap can be varied here, the bearing beam 42 is provided with means (not shown) which enable the bearing beam 42 to lift and lower, as indicated by arrow 101.

Fig. 5 shows a further means of mounting the metering ledge 12. Two guide links 44 and 45 are each articulated by means of hinge pins 46 and 47 at both front ends on the metering ledge 12c, which extends over at least one area along a generating line of the inking roller 6. Guide link 44 and guide link 45 are each connected in an articulated manner to two pivot levers 48 and 49 so that guide link 44 forms with pivot lever 48 the articulation 50 and with pivot lever 49 the articulation 51, and guide link 45 forms with pivot lever 48 the articulation 52 and with pivot lever 49 the

articulation 53. Guide link 44 is parallel to guide link 45. Pivot lever 48 and pivot lever 49 are parallel to the metering ledge 12c. The metering ledge 12c again has an edge 54 which faces the inking roller 6 and has a cylindrical surface with a cylinder axis 55 thereby established. Cylinder axis 55 is at a distance a from the articulation 46. Pivot Lever 48 and pivot lever 49 are extended upwards in Fig. 5. Attached to these extensions are bearings which are placed rotatably onto fixed spindles 56 and 57. Spindle 56 is likewise at a distance a from articulation 50, and likewise spindle 57 is at a distance a from articulation 51. A pneumatic cylinder is fixed to articulation 53 in such a way that it can set pivot lever 49 in a pivoting movement about spindle 57, as shown by arrow 59. This movement is transmitted to the pivot lever 48 and the metering ledge 12c via the guide links 44 and 45. As a result, the metering ledge rotates about the rotational axis 50 coinciding with the cylinder axis 55. The spindle 57 can be attached in such a way that its position is displaceable about the spindle 56, as indicated by arrow 61, and can be fixed again in the new position. By this displacement of the spindle 57 about the spindle 56, the width of the metering gap 62 between metering ledge 12c and the inking roller 6 can be set.

In order to prevent the edge 63 of the metering ledge 12d facing the inking roller 6 from being destroyed by wear, which edge 63 has to be machined very precisely, the metering ledge 12d can be provided with a protective layer 64, as shown by Fig. 6. The protective layer 64, which consists of a flexible, foil-like plate, is put, on one side of the metering ledge 12d, into a number of lugs 65, attached so as to be distributed over the width of the metering ledge 12d, stretched over the edge 63 forming the metering gap 66 and, on the other side of the metering ledge 12d, firmly clamped with a clamping strip 67 by means of screws 68 which are likewise arranged over the entire width of the metering ledge 12d. If wear is excessive, only the protective layer 64 has to be

exchanged; the metering ledge 12d continues to be used. This can be a cost-saving measure.

Another means of moving the area of the metering ledge 12e forming the metering gap is shown in Fig. 7. The metering ledge 12e is composed of a supporting element 70, which is fixed on a solid base 71, and a flexible, foil-like plate 72 stretched over the supporting element 70. The edge 73 of the supporting element 70 facing the inking roller 6 has an arched shape. Grooves 74 are made in the supporting element 70 so as to be distributed over its width. Rocking bodies 76 are attached non-rotationally on a through shaft 75 mounted in the webs remaining between the grooves 74. The flexible, foil-like plate 72 is provided on both sides with brackets 77 which are fixed to the rocking bodies 76 by means of screws 78. A lever 79 is likewise connected non-rotationally to the shaft 75. On its side 80 remote from the shaft 75, it is articulated on a pneumatic cylinder 81 which transmits via the lever 79 an oscillating swinging movement, shown by arrow 82, to the rocking bodies 76. The flexible, foil-like plate is thereby moved reciprocatingly in an oscillating manner over the edge 73 facing the inking roller 6.

Unlike the embodiment shown in Fig. 7, Fig. 8 shows a metering ledge 12f which has a flexible, foil-like plate 83 which is mounted in a fixed manner at one end 84, while the other end 85 is held by means of resilient clamping means 86. A supporting element 87, over whose edge 88 facing the inking roller 6 the flexible, foil-like plate 83 is stretched, is fixed in each case to a pivot lever 89 on the front ends of the inking roller 6, which pivot levers 89 are in turn mounted in an articulated manner on the rotational axis 90 of the inking roller 6. The stirrup formed by the pivot levers 89 and the supporting element 87 is pivoted in an oscillating manner by means not shown through the angle β about the rotational axis 90 of the inking roller 6. In this way, too, the area, forming the metering gap, of the flexible, foil-like plate is constantly changed.

The two end positions of the pivoting movement are shown in Fig. 8: the position on the left is shown by dotted lines, and the position on the right is shown by solid lines.

In Fig. 9, the metering ledge 12g is composed of a supporting beam 91 which is provided with a recess 92 which forms a bearing shell and is made on the edge 93 facing the inking roller 6. A cylindrical bar 94 is rotatably mounted in this recess 92. By means not shown, the cylindrical bar 94 can be set in a rotating or oscillating movement, as indicated by arrow 95. In this way, too, another area of the cylindrical bar 94 together with the inking roller 6 always forms the metering gap 96.

As tests have shown, good printing results are achieved when the surface of the metering ledge 12 which is of cylindrical configuration and forms the metering gap has a radius in the order of magnitude of 0.3 to 1.5 mm. It has also been found that, when the contact pressure of the metering ledge 12 against the inking roller 6 is varied, the thickness of the ink film changes only slowly, whereby, by varying the contact pressure, a very fine graduation in the ink film thickness can be achieved. When the contact pressure of the metering ledge 12 against the inking roller 6 is uniform, a substantially greater effect on the ink film thickness results by varying the radius of the cylindrical surface of the metering ledge 12 forming the metering gap.

The optimum radius can thus be used as a function of the surface hardness of the resilient packing on the inking roller 6 and the viscosity of the ink. Moving the metering ledge 12 in the ways described does not affect the ink film created, since the geometric relationships in the metering gap always remain the same.

In addition, the tests have also shown that the metering ledge 12 is preferably disposed in an approximately radial direction relative to the inking roller 6.

Inking units of this type, aside from being used in the offset printing machine embodiment described, can also be used to equip printing machines which use another

printing technique, in particular a printing technique
which relies on a rigid printing forme.

Claims:

1. An inking unit for a printing machine, comprising at least one forme cylinder, for carrying a printing forme, an inking roller which can be set against the forme cylinder and has a resilient surface, an inking device which inks the inking roller, and a metering device which can be set against the inking roller, characterized in that the inking device produces a premetered ink film on the inking roller, the metering device comprises at least one metering ledge which wipes the premetered ink film on the inking roller to the size required for transfer to the forme cylinder, the excess ink wiped from the metering ledge runs off freely, the metering ledge is mounted in such a way that at least part of the metering ledge forming the metering gap, for the purpose of constant self-cleaning, can be set in an oscillating movement in such a way that another area of the metering ledge, together with the inking roller, constantly forms the metering gap.
2. An inking unit as claimed in claim 1, in which the edge of the metering ledge facing the inking roller and forming the metering gap has an arched shape.
3. An inking unit as claimed in claim 1 or 2, in which the metering ledge is disposed substantially radially

relative to the inking roller.

4. An inking unit as claimed in any of claims 1 to 3, including adjusting means for setting the gap width between the metering ledge and the inking roller.

5. An inking unit as claimed in any of claims 1 to 4, in which the metering ledge is pivotable in an oscillating manner through a given angle about a rotational axis parallel to the axis of the inking roller.

6. An inking unit as claimed in claim 5, in which the angle through which the metering ledge can be pivoted is in the range of 5° to 30°.

7. An inking unit as claimed in claim 5 or 6, in which the edge of the metering ledge is rounded off cylindrically, and the rotational axis of the metering ledge coincides with the axis of the cylinder defined by the said edge.

8. An inking unit as claimed in any of claims 5 to 7, in which arranged on the front ends of the metering ledge are bearing journals whose central axes coincide with the rotational axis of the metering ledge and which are mounted in bearings fixed to a machine frame.

9. An inking unit as claimed in any of claims 1 to 7, in which the metering ledge, on the side remote from the inking roller, has a cylindrical surface which is at a constant distance from the rotational axis of the metering ledge and rests on bearing means on a corresponding surface of a bearing beam so as to be pivotable about the rotational axis of the metering ledge.
10. An inking unit as claimed in any of claims 1 to 7, in which the metering ledge is connected in an articulated manner to at least two guide links which are parallel to one another and are in turn articulated on at least two pivot levers which are parallel to the metering ledge and are held at one of their ends in fixed bearings, the centres of rotation of the fixed bearings of the pivot levers and the centre of rotation of the rotational axis of the metering strip lying in a straight line.
11. An inking unit as claimed in claim 10, in which one of the fixed bearings of the pivot levers is designed so as to be adjustable about the other fixed bearing.
12. An inking unit as claimed in claim 5 or any claim dependent thereon, including a drive for effecting the pivoting movement.

13. An inking unit as claimed in any of claims 1 to 12, in which the metering ledge, in particular in the area forming the metering gap, is provided with an easily exchangeable protective layer.

14. An inking unit as claimed in claim 13, in which the protective layer comprises a flexible, foil-like plate which is held by fixing and clamping means attached to the metering ledge.

15. An inking unit as claimed in any of claims 1 to 4, in which the metering ledge comprises a fixed supporting element over whose edge facing the inking roller a flexible, foil-like plate is stretched, and means for moving the flexible plate reciprocatingly in an oscillating manner in the peripheral direction of the inking roller.

16. An inking unit as claimed in any of claims 1 to 4, in which the metering ledge comprises a supporting element which can be pivoted through a given angle about the rotational axis of the inking roller and over whose edge facing the inking roller a flexible, foil-like plate is stretched, which is held in a fixed manner at one of its ends and is held by resilient clamping means at its other end.

17. An inking unit as claimed in any of claims 1 to 4, in which the metering ledge comprises a supporting beam on whose edge facing the inking roller a cylindrical bar is rotatably mounted and supported and is drivable in a rotating or oscillating manner.
18. An inking unit substantially as described with reference to any of the embodiments illustrated in the accompanying drawings.
19. A printing machine including an inking unit according to any preceding claim.

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